

NEW

OMRON

## SMART Sensor Series

Laser Displacement Sensor CMOS Type

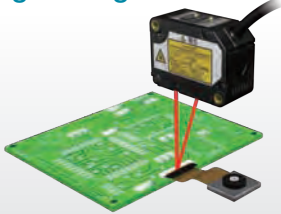
Model ZX2 Series

# Stable, Easy & Affordable



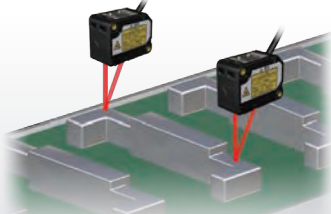
# One Solution for Any Application

Height/Length



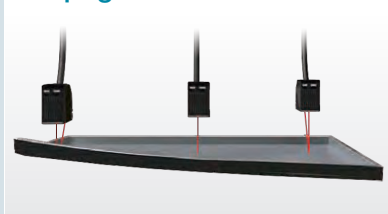
Thin connector assembly

Level detection



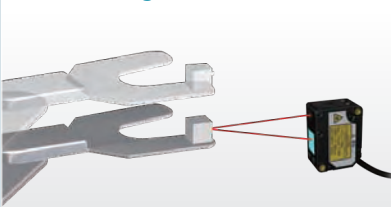
Shape validation for molded parts

Warpage



Tray warpage measurement

Positioning



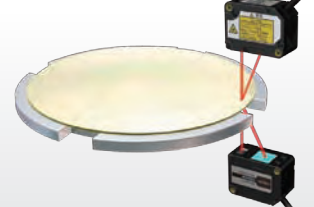
Robot hand positioning

Double feed



PCB double feed detection

Thickness



Wafer thickness measurement

# New

## Laser Displacement Sensor CMOS Type

### ZX2 Series

Realize stable measurements

**Resolution  $1.5\mu\text{m}$ <sup>\*1</sup>**

Reliable measurement of moving objects

**Measurement cycle  
30 $\mu\text{s}$**

Realize stable measurements at  $10\mu\text{m}$

**Linearity<sup>\*2</sup> 0.05% F.S.<sup>\*3</sup>**

Unaffected by environmental changes

**Temperature characteristic<sup>\*4</sup>  
0.02% F.S./ $^{\circ}\text{C}$ <sup>\*5</sup>**

<sup>\*1</sup> When employing Models ZX2-LD50/LD50L (50mm type)

<sup>\*2</sup> Linearity : Maximum error produced when measuring within measurement range

<sup>\*3</sup> Linearity  $\pm 0.05\%$  F.S. indicates the maximum error is  $10\mu\text{m}$  in the case of using Model ZX2-LD50L with a 40-50mm measurement range.

<sup>\*4</sup> Temperature characteristic : Error produced when the ambient temperature varies by  $1^{\circ}\text{C}$

<sup>\*5</sup> Linearity  $\pm 0.02\%$  F.S./ $^{\circ}\text{C}$  indicates the maximum error is  $4\mu\text{m}$  when the ambient temperature varies by  $1^{\circ}\text{C}$  in the case of using Models ZX2-LD50/LD50L with a measurement range  $\pm 10\text{mm}$ .



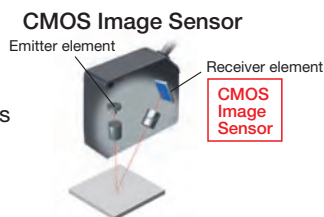
# Stable Measurement and Easy to Use

Stability

## Stable measurements in case of color/material and moving objects

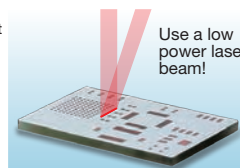
### Dynamic range a million times

Realizes stable measurements for any color or surface condition including metals, substrates, elastomers and transparent materials through the employment of Omron's own HSDR-CMOS (High Speed and Dynamic Range) image sensor and a step-less laser power adjustment algorithm. A line beam is used in addition to an emitter beam, ideally configured with a Omron sensor lens. Stable measurements are thereby realized, in moving applications.

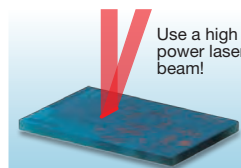


### Step-less adjustment of laser power

For high reflectance, brightly colored workpiece

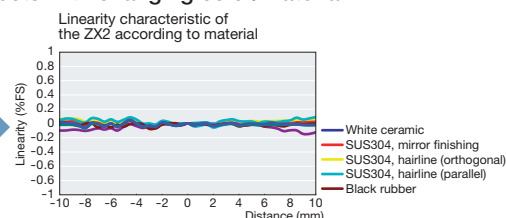
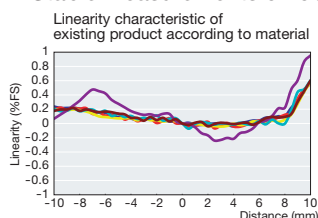


For low reflectance, darkly colored workpiece

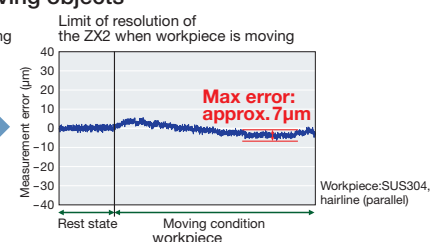
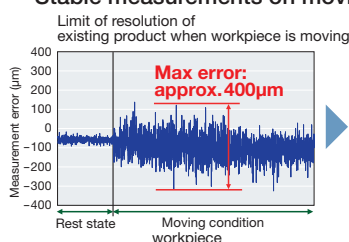


PAT.P

### Stable measurements on objects with changing color/material



### Stable measurements on moving objects



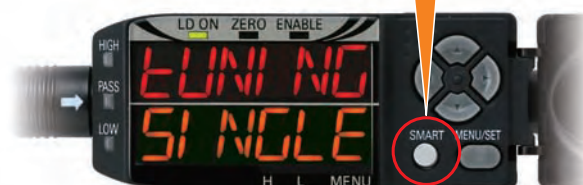
Easy

## Easy and User-friendly Configuration

### Smart tuning

The ideal configuration for stable measurements is realized by a single button through the new feature "smart tuning", and no longer depends on the skill of the user. A reliable configuration is achieved by three tuning methods, which can be selected to match the type of object and surface conditions to be measured.

Sensor configuration by just a pushing the SMART button



PAT.P

### Three selectable tunings

#### One type of workpiece



#### Single smart tuning

Best configuration for stable detection in case of objects do not change by pushing the button for one second

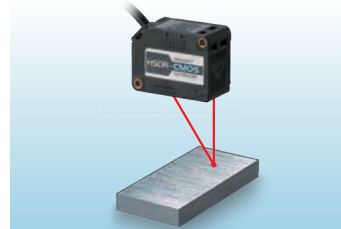
#### Several types of workpiece



#### Multi-smart tuning

Ideal configuration for stable detection of changing objects by pushing the button for three seconds

#### Surface conditions of the workpiece are variable



#### Active smart tuning

Continuous configuration improvement for the stable detection of all locations by pushing the button for five seconds

# Sensor Heads for Various Applications -select the Range and Type of Beam

## ZX2-LD50L Line beam type ZX2-LD50 Spot beam type

|                     |   |
|---------------------|---|
| ● Measurement range | 50mm±10mm   |
| ● Resolution        | 1.5μm   |
| ● Linearity         | Line beam ±0.05%F.S.*1<br>Spot beam ±0.10%F.S.*1          |
| ● Beam size         | Line beam Approx.60μm×2.6mm<br>Spot beam Approx.60μm dia. |

### Spot beam

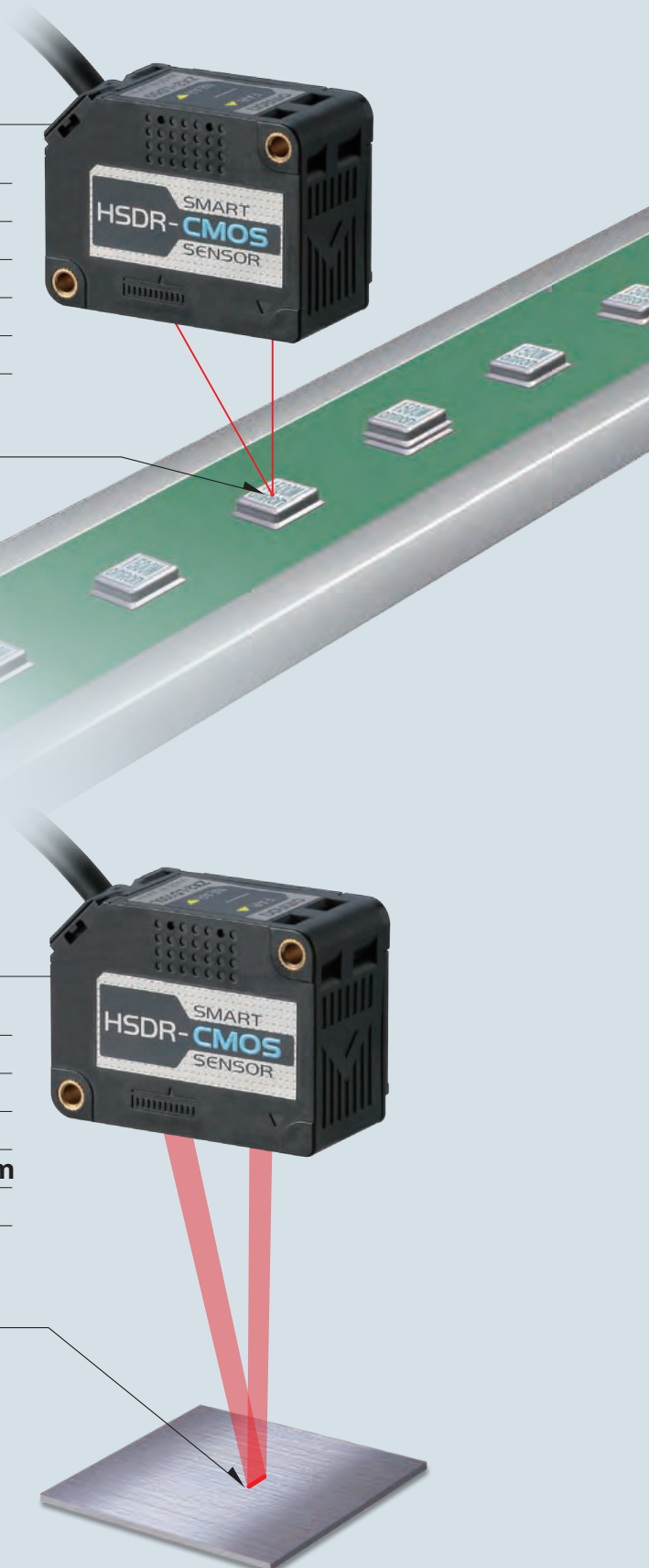
Precise measurement on micro-scale objects

## ZX2-LD100L Line beam type ZX2-LD100 Spot beam type

|                     |   |
|---------------------|---|
| ● Measurement range | 100mm±35mm  |
| ● Resolution        | 5μm   |
| ● Linearity         | Line beam ±0.05%F.S.*2<br>Spot beam ±0.10%F.S.*2            |
| ● Beam size         | Line beam Approx.110μm×2.7mm<br>Spot beam Approx.110μm dia. |

### Line beam

Stable measurement on rough-surfaced objects



\*1 Using 40 to 50mm  
\*2 Using 65 to 100mm





# Support for Various Environments/Space-Saving ●●● The Smart Sensor Head

## Reliable measurements in harsh environments

IP67, robot cable  
& temperature characteristic 0.02% F.S./°C

IP67 protection class enables to use the sensor in harsh environments. A robot cable is used as standard between the head and amplifier, that the unit can be used reliably on moving parts. In addition, as 3D UV bond is used to fix the optical components rather than screws, stress can be controlled and a temperature characteristic 0.02% F.S./°C\* is realized.

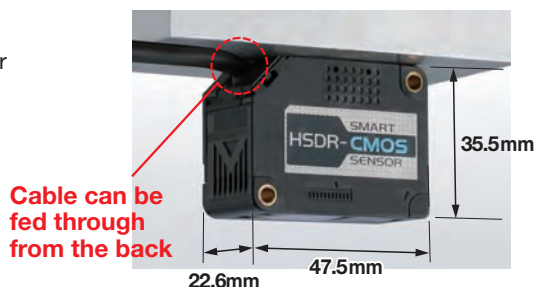
\* If the room temperature varies 1°C, the measured value varies 0.02% F.S.  
(corresponding to 4μm for the Model ZX2-LD50)



## Compact sensor for easy mounting

World smallest\*

The world's smallest CMOS laser displacement sensor head is realized in a resin case. Enables to mount the sensor in smallest spaces and to minimize measurement errors arising from temperature fluctuations.



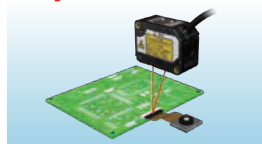
## 10μm precision measurements

Linearity to meet the application

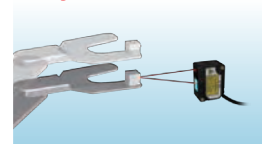
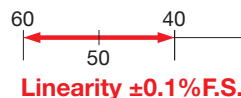
Measurements to an even higher accuracy are realized for applications that do not require the entire measurement range. If the range of the field is less than the length of the measurement center, linearity accuracy improves by 50% compared with that for the full range.\*

\* Model ZX2-LD□L

Model ZX2-LD50L



Example of an application that does not require the entire measurement range  
Low-profile connector assembly height measurement



Example of an application that requires the entire measurement range  
Robot hand registration

## Visualization to prevent from stopping the production-line

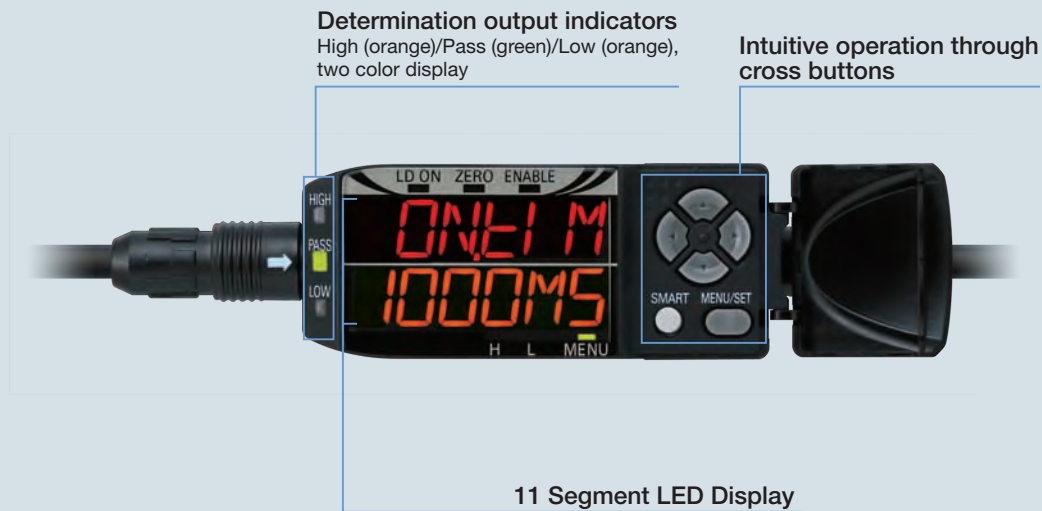
Laser life display function

The end of the laser diode lifespan is automatically detected and displayed so maintenance can be performed systematically. On the main digital display of the amplifier, this is indicated by an LED on the back of the head. Accordingly, in case of amplifier is within the control panel, the lifetime can be confirmed by the head and the indications are not missed.

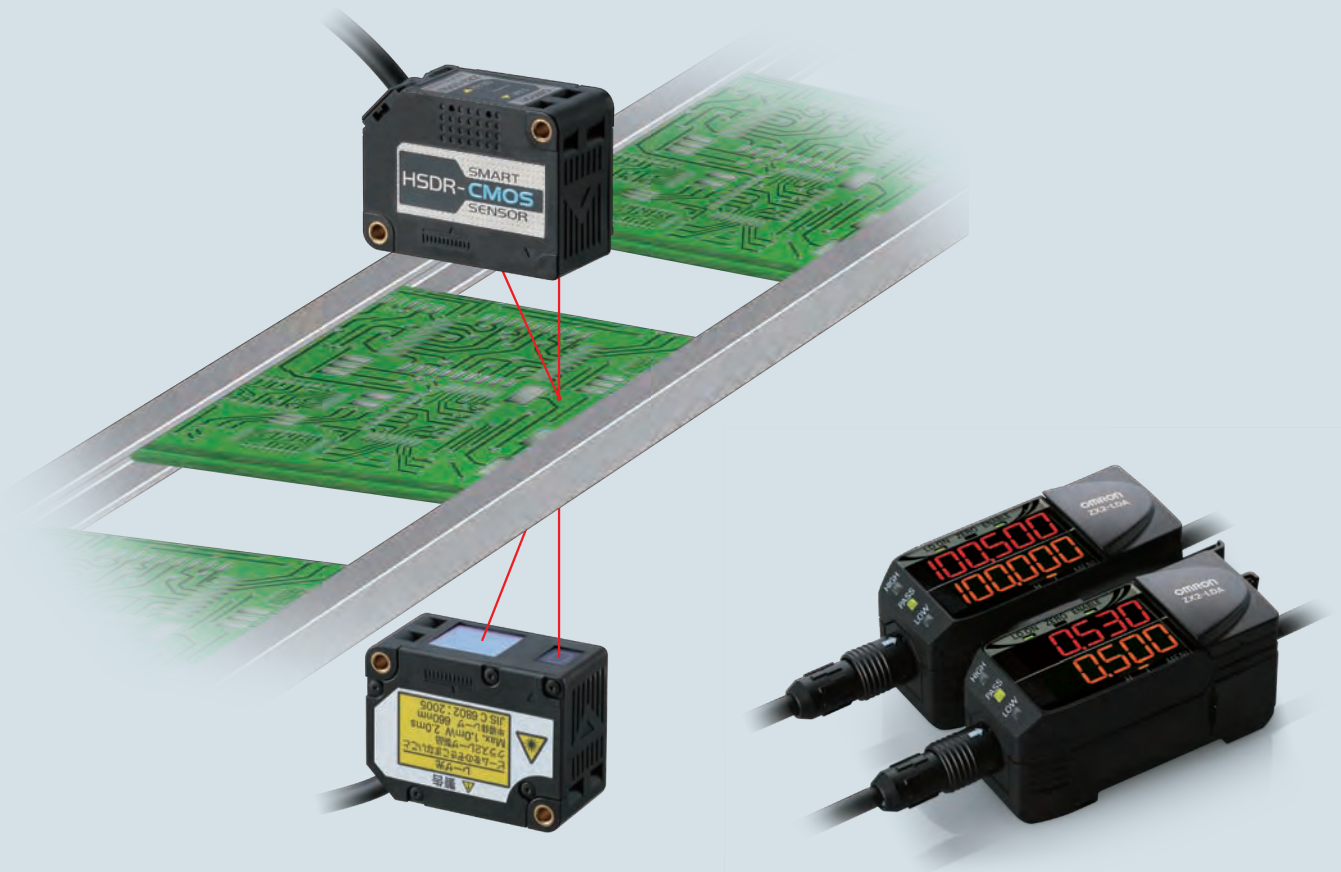


## Ease of Use by “LED Display” and “Calculating Unit”

### 11-segment LED display for intuitive configuration



### Easy calculations of measurements





A thorough pursuit  
of user-friendliness

## ●●● The Smart Amplifier Unit

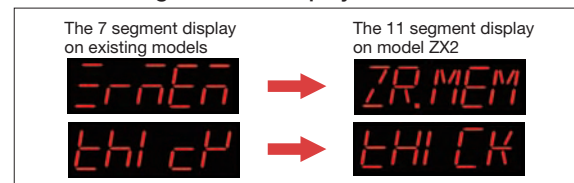
### No need for a manual

#### 11 Segment LED Display

An 11 segment LED display is integrated in the compact housing. Alphanumeric characters can be read with ease and there is no need to refer to a manual.



Comparison of the existing 7 segment LED display and the 11 segment LED display



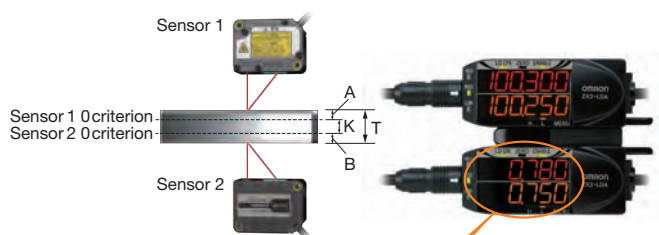
The compact housing stays just as it is

### Perform two calculations with ease

#### Thickness + subtraction mode

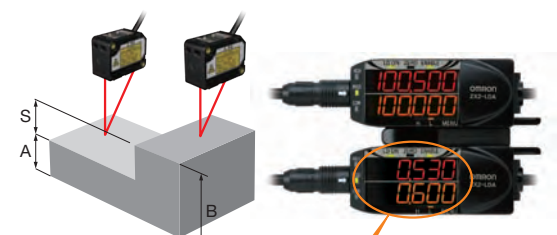
The calculated results of two sensors are displayed on the amplifier by just connecting the calculating unit between the two amplifiers. The calculation function can be chosen from the two modes of thickness and subtraction. It is also possible to prevent mutual interference by coupling via the calculating units.

##### Thickness mode



Thickness  $T = K + (A + B)$

##### Subtraction mode



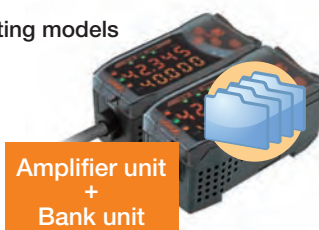
Level difference  $S = B - A$

### Easy change of setup

#### Equipped with 4 banks

The amplifier unit is equipped with four bank functions. Easy change of setup between four modes is supported by just switching between the bank functions.

Existing models



Amplifier unit  
+  
Bank unit

ZX2

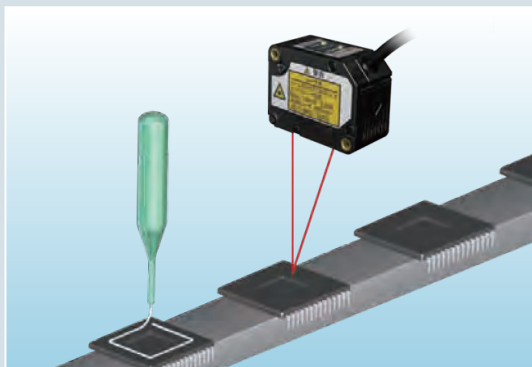


Built into the unit

# One Sensor for Any Measurement Application

## Height/ Length

Height measurements prior  
to IC package sealing

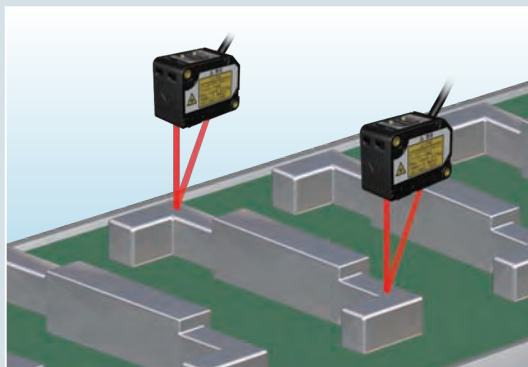


### Point

Stable measurements can be performed by the HSDR-CMOS image sensor and Omron's proprietary algorithm, even for measurements on moving IC packages.

## Level detection

Shape validation  
for molded parts

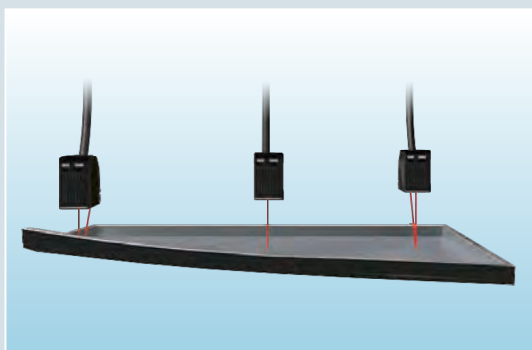


### Point

Calculation of the measured values can be carried out and the difference in level can be easily measured by just connecting the calculating unit between two amplifiers. Even if the surface conditions of a molded part varies, application of a line beam and HSDR-CMOS image sensor results in almost no fluctuation in measured value.

## Warpage

Tray flatness measurement  
prior to chip firing

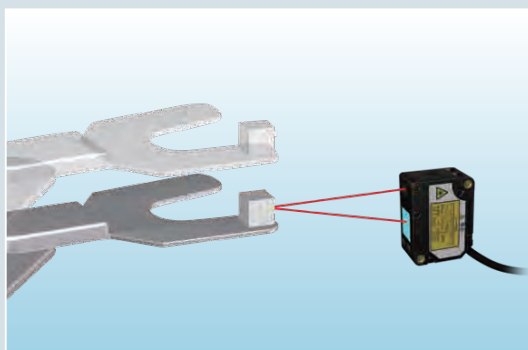


### Point

Even if there is temperature variation due to the ambient temperature, a die-cast is used for the optical base and so there is almost no fluctuation in measured value.

## Positioning

Robot hand Positioning

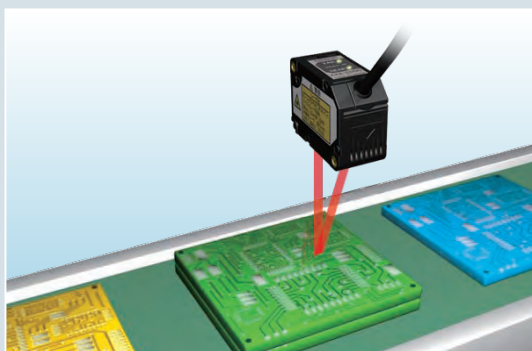


### Point

Stable measurements can be performed by the HSDR-CMOS image sensor and Omron's proprietary algorithm even for robot hand registration.

## Double feed

PCB double feed detection

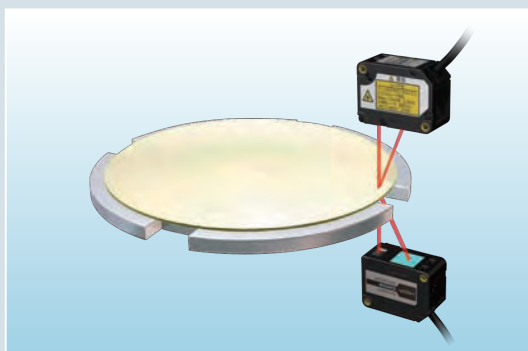


### Point

Even if the color of the substrate changes, application of the HSDR-CMOS image sensor and Omron's proprietary algorithm results in almost no fluctuation in measured value.

## Thickness

Wafer thickness  
measurement



### Point


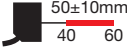
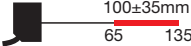
Calculation of the measured values can be carried out and the thickness can be easily measured by just connecting the calculating unit between two amplifiers.




## Ordering Information

### Units

#### Sensor Heads


| Appearance   | Beam shape | Sensing distance   | Resolution | Model      |
|--|------------|--|------------|------------|
| Diffuse reflection type<br> | Line beam  |  50±10mm<br>40 60   | 1.5μm      | ZX2-LD50L  |
|  | Spot beam  |  |            | ZX2-LD50   |
|  | Line beam  |  100±35mm<br>65 135 | 5μm        | ZX2-LD100L |
|  | Spot beam  |  |            | ZX2-LD100  |

#### Amplifier Units

| Appearance  | Power supply | Output type | Model     |
|---|--------------|-------------|-----------|
|  | DC           | NPN         | ZX2-LDA11 |
|   |              | PNP         | ZX2-LDA41 |

**Accessories (sold separately)** These are not included with the Sensor Head or Amplifier Unit. Please order as necessary.

#### Calculating Unit

| Appearance  | Model   |
|---|---------|
|  | ZX2-CAL |

#### Sensor Head Extension Cables

| Cable Length | Model    |
|--------------|----------|
| 1m           | ZX2-XC1R |
| 4m           | ZX2-XC4R |
| 9m           | ZX2-XC9R |

\* Extension cables cannot be coupled and used together.

## Specifications

### Sensor Heads

| Item                               | Model | ZX2-LD50L  | ZX2-LD50  | ZX2-LD100L   | ZX2-LD100  |
|------------------------------------|-------|--|---|--|--|
| Optical system                     |       | Diffuse reflective   |   |  |  |
| Light source (wave length)         |       | Visible-light semiconductor laser with a wavelength of 660 nm and an output of 1mW max.<br>EN class 2,FDA class II*5 |   |  |  |
| Measurement center point           |       | 50mm   |   | 100mm  |  |
| Measurement range                  |       | ±10mm  |   | ±35mm  |  |
| Beam shape                         |       | Line   | Spot  | Line   | Spot   |
| Beam size *1                       |       | Approx. 60μm×2.6mm   | Approx. 60μm dia.                                   | Approx.110μm×2.7mm                                   | Approx.110μm dia.                                    |
| Resolution *2                      |       | 1.5μm  |   | 5μm  |  |
| Linearity *3                       |       | ±0.05%F.S. (40 to 50mm)<br>±0.1%F.S. (entire range)  | ±0.1%F.S. (40 to 50mm)<br>±0.15%F.S. (entire range) | ±0.05%F.S. (65 to 100mm)<br>±0.1%F.S. (entire range) | ±0.1%F.S. (65 to 100mm)<br>±0.15%F.S. (entire range) |
| Temperature characteristic *4      |       | 0.02%F.S./°C   |   |  |  |
| Ambient illumination               |       | Incandescent lamp: 10,000lx max. (on light receiving side)   |   |  |  |
| Ambient temperature                |       | Operating: 0 to +50°C, Storage: -15 to +70°C (with no icing or condensation)   |   |  |  |
| Ambient humidity                   |       | Operating and storage: 35% to 85% (with no condensation)   |   |  |  |
| Dielectric strength                |       | 1,000 VAC, 50/60 Hz for 1 min.   |   |  |  |
| Vibration resistance (destruction) |       | 10 to 150 Hz, 0.7-mm double amplitude, 80 min. each in X,Y,and Z directions  |   |  |  |
| Shock resistance (destruction)     |       | 300 m/s <sup>2</sup> 3 times each in six directions (up/down,left/right,forward/backward)                            |   |  |  |
| Degree of protection               |       | IEC60529, IP67   |   |  |  |
| Connection method                  |       | Connector connection (standard cable length: 500 mm)   |   |  |  |
| Weight (packed state)              |       | Approx.160g (unit only: Approx.75g)  |   |  |  |
| Materials                          |       | Case and cover: PBT (polybutylene terephthalate), Optical window: Glass, Cable: PVC                                  |   |  |  |
| Accessories                        |       | Instruction sheet, Ferrite core, Laser warning label (English)   |   |  |  |

Note) False detection outside the measurement range can occur in the case of an object with high reflectance.

\*1. Beam size: Defined as 1/e<sup>2</sup> (13.5%) of the central intensity at the smallest value of diameter for the measurement range (typical value)

False detections can occur in the case there is light leakage outside the defined region and the surroundings of the target object have a high reflectance in comparison to the target object.

\*2. Resolution: indicates the degree of fluctuation (±3σ) of analog output when connected to the ZX2-LDA.

(Indicates the measured value for the case the response time of the ZX2-LDA is configured to 128ms and Omron's standard target object (white ceramics) is made the center distance.)

Indicates the repetition accuracy for when the workpiece is in a state of rest. Not an indication of distance accuracy.

Resolution performance may not be satisfied in a strong electromagnetic field.

\*3. Linearity: indicates the error with respect to the ideal straight line of the displacement output in the case of measuring Omron's standard target object. Linearity and measured value may vary depending on target object.

F.S. indicates the full scope of the measurement range. (ZX2-LD50□: 20mm)

\*4. Temperature characteristic: Value for the case the space between the sensor head and Omron's standard target object is secured by an aluminum jig. (Measured at the measurement center distance)

\*5. Classified as Class 2 by EN60825-1 criteria in accordance with the FDA standard provisions of Laser Notice No.50. Notification to CDRH planned.

## Amplifier Units

| Item   | Model | ZX2-LDA11   | ZX2-LDA41  |
|--|-------|---|--|
| Measurement period *1  |       | Min. 30μs   |  |
| Response time  |       | 60μs, 120μs, 240μs, 500μs, 1ms, 2ms, 4ms, 8ms, 12ms, 20ms, 36ms, 66ms, 128ms, 250ms, 500ms  |  |
| Analog output *2   |       | 4 to 20 mA, Max. load resistance: 300Ω, ±5VDC or 1 to 5 VDC, Output impedance: 100Ω   |  |
| Judgement outputs (HIGH/PASS/LOW: 3 outputs), error output               |       | NPN open-collector outputs, 30 VDC, 50 mA max. (residual voltage: 1V max. for load current 10mA max., 2V max. for load current above 10mA)  | PNP open-collector outputs, 30 VDC, 50 mA max. (residual voltage: 1V max. for load current 10mA max., 2V max. for load current above 10mA) |
| Laser OFF input, zero reset input, timing input, reset input, bank input |       | ON: Short-circuited with 0-V terminal or 1.2V or less<br>OFF: Open (leakage current: 0.1 mA max.)   | ON: Supply voltage short-circuited or supply voltage within -1.2V<br>OFF: Open (leakage current: 0.1 mA max.)                              |
| Functions  |       | Smart tuning, scaling, sample hold, peak hold, bottom hold, peak-to-peak hold, self-peak hold, self-bottom hold, average hold, zero reset, On-delay timer, OFF-delay timer, keep/clamp switch, (A-B)calculations *3, thickness calculation *3, mutual interference prevention *3, laser deterioration detection, bank function(4 banks) |  |
| Indications  |       | Judgement indicators: HIGH(orange),PASS(green),LOW(orange),11-segment main display(red),11-segment sub-display(orange),laser ON(green),zero reset(green),enable(green),menu(green), HIGH threshold(orange),LOW threshold(orange)  |  |
| Power supply voltage   |       | 10 to 30 VDC, including 10% ripple(p-p)   |  |
| Power consumption  |       | 3,000 mW max. with power supply voltage of 30 VDC and power supply current of 100 mA (with Sensor connected)  |  |
| Ambient temperature  |       | Operating: 0 to +50°C, Storage: -15 to +70°C (with no icing or condensation)  |  |
| Ambient humidity   |       | Operating and storage: 35% to 85% (with no condensation)  |  |
| Dielectric strength  |       | 1,000 VAC, 50/60 Hz for 1 min.  |  |
| Vibration resistance (destruction)                                       |       | 10 to 150 Hz, 0.7-mm double amplitude, 80 min. each in X,Y,and Z directions   |  |
| Shock resistance (destruction)   |       | 300 m/s <sup>2</sup> 3 times each in six directions (up/down,left/right,forward/backward)   |  |
| Degree of protection   |       | IEC60529, IP40  |  |
| Connection method  |       | Prewired (standard cable length: 2 m)   |  |
| Weight (packed state)  |       | Approx.200g (unit only: Approx.135g)  |  |
| Materials  |       | Case: PBT(polybutylene terephthalate), Cover: Polycarbonate, Display: Acrylic resin, Button: Polyacetal, Cable: PVC   |  |
| Accessories  |       | Instruction sheet   |  |

\*1. In the case of Omron's standard target object (white ceramic)

\*2. Configure current output (4 to 20mA) and voltage output (±5V or 1 to 5V) by MENU mode.

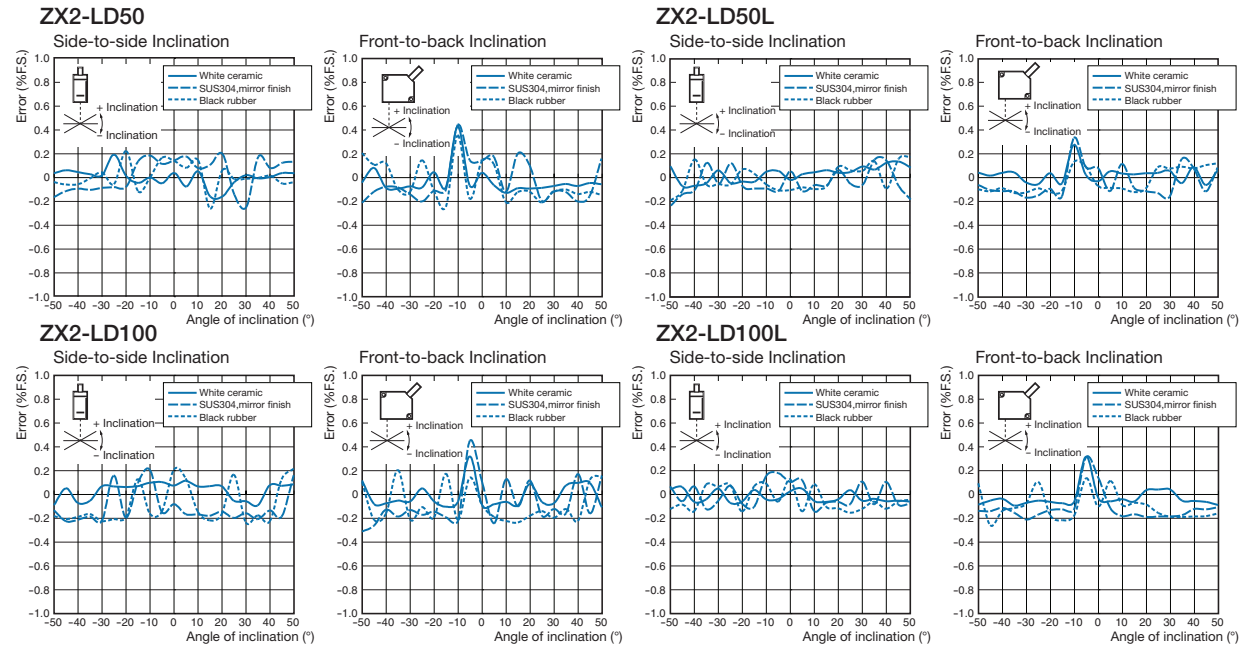
\*3. Calculating unit (ZX2-CAL) is necessary.

## Calculating Unit

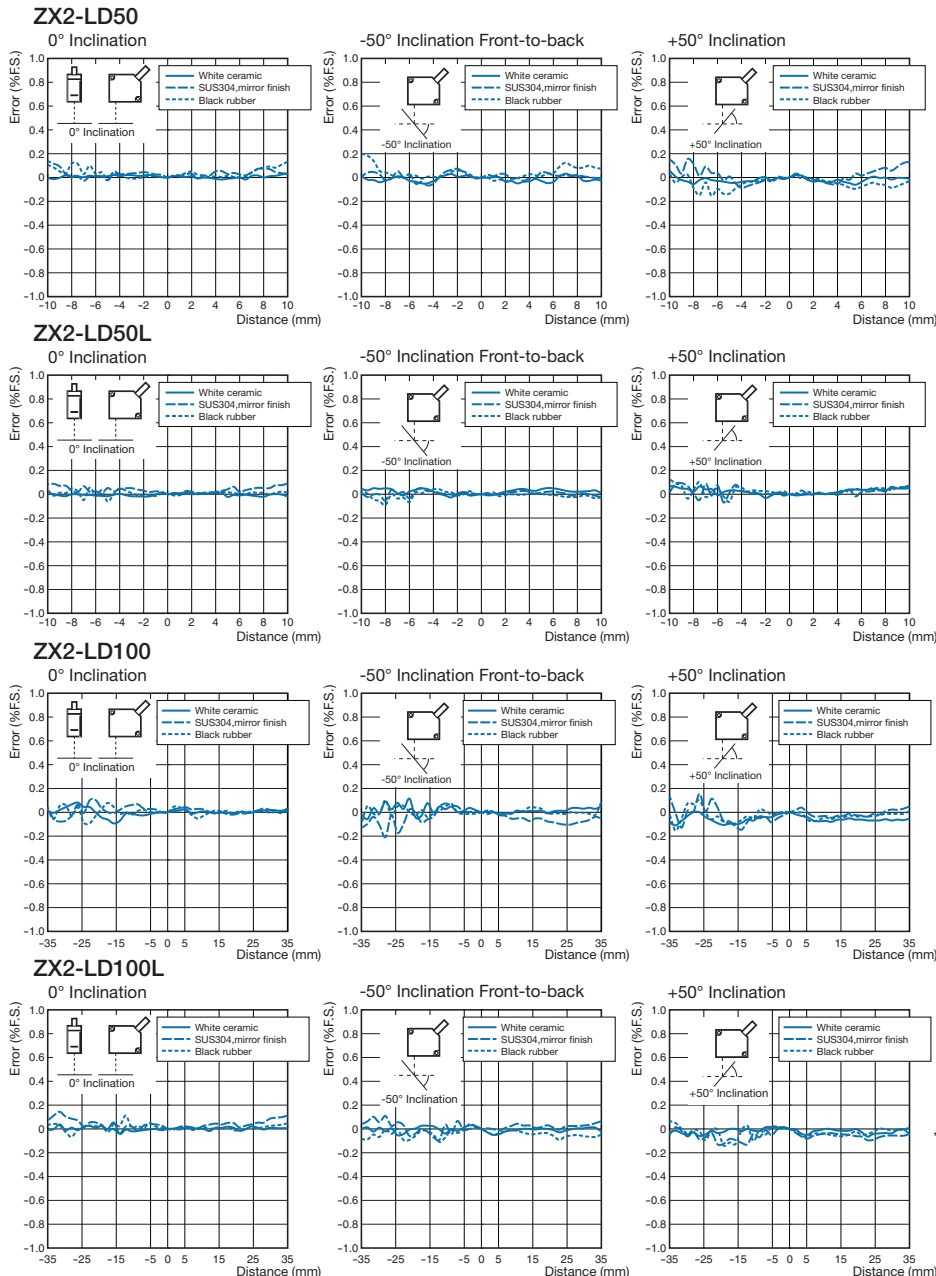
| Item                               | Model | ZX2-CAL  |
|------------------------------------|-------|--|
| Applicable Amplifier Units         |       | ZX2-LDA11/ZX2-LDA41  |
| Current consumption                |       | 12mA max (supplied from the Smart Sensor Amplifier Unit)                                   |
| Ambient temperature                |       | Operating: 0 to +50°C, storage: -15 to +70°C (with no icing or condensation)               |
| Ambient humidity                   |       | Operating and storage: 35 to 85% RH (with no condensation)                                 |
| Connection method                  |       | Connector  |
| Dielectric strength                |       | 1,000VAC, 50/60 Hz for 1min.   |
| Insulation resistance              |       | 100MΩ min. (at 500VDC)   |
| Vibration resistance (destructive) |       | 10 to 150Hz, 0.7-mm double amplitude, 80min. each in X,Y,and Z directions                  |
| Shock resistance (destructive)     |       | 300m/s <sup>2</sup> 3 times each in six directions (up/down, left/right, forward/backward) |
| Materials                          |       | Case: PBT (polybutylene terephthalate), Display: Acrylic resin                             |
| Weight (packed state)              |       | Approx. 50g  |
| Accessories                        |       | Instruction sheet  |

# Engineering Data (Typical)

## Angle Characteristic



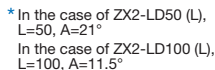
## Linearity Characteristic for Different Materials



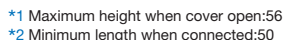
\* The x-axis distance indicates the measurement distance displayed by the amplifier unit. The measurement distance displayed by the amplifier unit takes the measurement center distance as 0 and displays the near-field from the sensor as plus and the far-field as minus.

(Unit: mm)

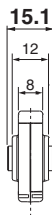
ZX2-LD50/ZX2-LD50L  
ZX2-LD100/ZX2-LD100L



## ZX2-LDA11/ZX2-LDA41



## ZX2-CAL



ZX2-XC1R  
ZX2-XC4R  
ZX2-XC9R



Vinyl insulated round cable,  
5.2 dia., 11 conductors  
(Conductor cross-section: 0.09mm<sup>2</sup>/  
Insulator diameter: 0.7mm)  
Standard length: 2m



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